



JUN 18 10 14 AM '99

VERMONT
VT

June 16, 1999

Ms. Lynda Provencher
Vermont ANR/DEC
Waste Management Division
103 South Main St. /West Building
Waterbury, VT 05671-0404

RE: Initial Investigation of Suspected Subsurface Petroleum Contamination
R. Kaigles Citgo, Burlington, Vermont (VTDEC Site #99-2579)

Dear Ms. Provencher:

Enclosed please find the summary report for the site investigation conducted at the above referenced site.

Please contact me if you have any questions or comments.

Sincerely,

Christine Ward
Hydrogeologist

Enclosure

c.: Mr. Dennis Boise, COCO (w/o enclosure)
GI#39941496

**INITIAL INVESTIGATION OF
SUSPECTED SUBSURFACE PETROLEUM
CONTAMINATION**

**R. KAIGLES CITGO
210 SHELBURNE ROAD
BURLINGTON, VERMONT**

(VTDEC SITE #99-2579)
GI #39941496

June 1999

Prepared for

Champlain Oil Company
P.O. Box 2126
South Burlington, VT 05407

Prepared by



P.O. Box 943
Williston, Vermont 05495
(802) 865-4288

TABLE OF CONTENTS

I. INTRODUCTION	1
II. SITE BACKGROUND	1
A. SITE HISTORY	1
B. SITE DESCRIPTION.....	1
C. SITE GEOLOGY	2
III. INVESTIGATIVE PROCEDURES	2
A. MONITORING WELL INSTALLATION.....	2
B. GROUNDWATER FLOW DIRECTION AND GRADIENT	3
C. GROUNDWATER SAMPLING AND ANALYSES.....	4
D. SENSITIVE RECEPTOR SURVEY	5
IV. CONCLUSIONS.....	5
V. RECOMMENDATIONS.....	7
REFERENCES.....	7

APPENDICES

Appendix A - Maps

 Site Location Map

 Site Map

 Groundwater Contour Map

 Contaminant Concentration Map

Appendix B - Soil Logs and Monitoring Well Specifications

Appendix C - Liquid Level Monitoring Data

Appendix D - Water Quality Data

Appendix E - Analytical Laboratory Report: Groundwater

I. INTRODUCTION

This report summarizes the initial investigation of suspected subsurface petroleum contamination at R. Kaigles Citgo (the Site) at 210 Shelburne Road in Burlington, Vermont (see Site Location Map, Appendix A). This work was requested by Lynda Provencher of the Vermont Department of Environmental Conservation (VTDEC) in a letter to Dennis Boise of Champlain Oil Company (COCO) dated February 9, 1999. This work was performed in accordance with the March 3, 1999, *Work Plan and Cost Estimate for a Subsurface Investigation* prepared by Griffin. The work plan was approved by Lynda Provencher (VTDEC) in a letter to Christine Ward (Griffin) dated March 18, 1999.

II. SITE BACKGROUND

A. Site History

On December 14 and 15, 1998, petroleum contamination was detected at the Site during soil field screening of the piping system upgrade for three gasoline underground storage tanks (USTs). Soil samples collected during the UST piping inspection were screened for volatile organic compounds (VOCs) using an HNuTM portable photoionization detector (PID) equipped with a 10.2 eV lamp. Soils collected from the excavation of the UST piping had VOC readings up to 200 parts per million (ppm) [2].

As a result of the petroleum contamination detected in the subsurface during the UST piping replacement inspection, the VTDEC requested that additional work be conducted at the Site in order to determine the extent and degree of petroleum contamination.

B. Site Description

R. Kaigles Citgo is located on the east side of Shelburne Road (Route 7), in a residential/commercial area of Burlington, Vermont. The Citgo station is a one story building with a slab on grade foundation. The office is located in the northwest corner of the building. The restrooms are located on the north side of the building. Two auto repair bays are located on the south side of the building. The ground surface topography at the site gently slopes down toward the west.

There are two 4,000-gallon and one 3,000-gallon capacity gasoline USTs located in a common tank field on the north side of the building. The fuel dispenser island is located on the west side of the building. There are two existing monitoring wells at the site: MW-1 is located on the east side of the tank field and MW-2 is located on the west side of the tank field.

leak
detection

The Site is bordered to the west by Shelburne Road; on the opposite side of the road are residences. The Site is bordered to the north by Alfred Street; Dunkin' Donuts is on the north side of Alfred Street. The area east and south of the site is primarily residential.

The Site and surrounding area are serviced by municipal water and sewer. Based on the dig safe markings, water service enters the building on the west side from Shelburne Road. According to representatives of the Citgo, the sewer service enters the building on the north side near the restrooms, however the exact location of the sewer line to the street is unknown. A map obtained from the Burlington Department of Public Works indicates a storm sewer pipe and a sanitary sewer pipe under Shelburne Road on the west side of the Citgo station and a combined sewer pipe under Alfred Street on the north side of the Citgo station.

C. Site Geology

According to the Surficial Geologic Map of Vermont [3], the Site is underlain by pebbly marine sand deposited in the Champlain Sea. Bedrock below the Site is mapped as the Monkton Quartzite, consisting of a distinctively red quartzite interbedded with lesser buff and with quartzite and relatively thick sections of dolomite [4].

III. INVESTIGATIVE PROCEDURES

To further define the extent of subsurface petroleum contamination in the area of the USTs and the fuel dispenser island, the following investigative tasks were undertaken: soil borings; monitoring well installations; determination of groundwater flow direction and gradient; groundwater sample collection and analyses for petroleum related constituents; and a sensitive receptor survey.

A. Monitoring Well Installation

Three shallow monitoring wells, MW-3 through MW-5, were installed on April 15, 1999, by Adams Engineering, under the direct supervision of a Griffin hydrogeologist. The soil borings for the monitoring wells were advanced with a truck mounted vibratory soil core sampler. The monitoring well locations are indicated on the Site Map (Appendix A).

Undisturbed soil samples collected from the borings with the core sampler, were logged by the supervising hydrogeologist and screened for the presence of VOCs using an HNu™ systems Model PI-101 PID equipped with a 10.2 eV lamp. Prior to screening, the PID was calibrated with isobutylene referenced to benzene. Soils were screened using the Griffin Jar/Polyethylene Bag Headspace Screening Protocol which conforms to state and industry standards. Soil

characteristics and contaminant concentrations were recorded by the hydrogeologist in detailed well logs which are presented in Appendix B.

Based on a review of the Burlington, VT, USGS topographic map [1] surface drainage patterns in the vicinity of the site appear to be directed to the west towards Lake Champlain. Monitoring well MW-3 was installed in a presumed upgradient direction from the USTs. MW-4 was installed in a presumed downgradient direction from the USTs and their associated piping. Monitoring well MW-5 was installed in a presumed downgradient direction from the fuel dispenser island.

The soil encountered at the surface in the borings for the three monitoring wells consisted primarily of sand and silt. This was underlain by brown sandy clay with gravel grading to a dense purple-gray till at the bottom of the boring in MW-3, and primarily by silt with sand and gravel in the borings for MW-4 and MW-5. Refusal was encountered with the core sampler on dense till in the borings for MW-4 and MW-5 at approximately 12 feet below grade.

No VOCs were detected with the PID at concentrations exceeding 1 ppm from the soils collected from the boring for monitoring well MW-3. Elevated VOCs were detected with the PID from the water saturated soils collected from near the water table interface in the borings for monitoring wells MW-4 and MW-5. The VOC readings detected from the soils in the borings for MW-4 and MW-5 then decreased with depth below the water table.

Each of the new monitoring wells was constructed in a similar fashion, with 1.5 inch diameter, Schedule 40 PVC well screen and riser. Each well contains a ten-foot length of 0.010-inch, factory-slotted screen. A sand pack was installed in the annular space around the well screen from the bottom of the boring to 1.5 feet above the top of the screened interval in the boring for MW-3 and 0.3 foot above the top of the screened interval in the borings for MW-4 and MW-5. A bentonite surface seal was then installed above the sand pack. Each well was fitted with a gripper cap and secured with a water-tight road box. The road box on each well is flush-mounted, and is suitable for vehicular traffic. The new monitoring wells were developed with a peristaltic pump immediately after installation.

B. Groundwater Flow Direction and Gradient

Water table elevation measurements were collected from the five on-site monitoring wells on April 29, 1999. The top of casing elevations were determined relative to MW-1, which was arbitrarily set at 100 feet. The depth to water in each well was subtracted from the top of casing elevation to obtain the relative water table elevation. Water level data are presented in Appendix C. No free phase product was detected in the wells on April 29, 1999. Water table elevations were plotted on the Site map to generate the Groundwater Contour Map figure presented in Appendix A.

The relative water table elevations measured on April 29, 1999, suggest that groundwater flow at the Site is generally directed toward the west-southwest at a hydraulic gradient of approximately 4.3%. The depth to groundwater measured in the monitoring wells on this date was approximately 4 to 6 feet below grade.

C. Groundwater Sampling and Analyses

Griffin collected groundwater samples from the five on-site monitoring on April 29, 1999. The water samples were analyzed by Endyne, Inc. of Williston, Vermont, by EPA Method 8021B for the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether (MTBE), naphthalene, and the alkylbenzenes: 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene.

Results of the laboratory analyses for the monitoring wells are summarized in Appendix D. The laboratory analysis report is contained in Appendix E. Analytical results of the trip blank and duplicate samples indicate that adequate quality assurance and control were maintained during sample collection and analysis.

A trace concentration of naphthalene, below the Vermont Groundwater Enforcement Standard (VGES) for this compound, was detected in the groundwater collected from the tank pit monitoring well MW-1. No other petroleum compounds targeted by the EPA Method 8021B analysis were detected in the groundwater sample collected from MW-1.

1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene were detected in the groundwater sample collected from tank pit monitoring well MW-2 in concentrations exceeding the VGES for these compounds. Concentrations of toluene, ethylbenzene, xylenes, and naphthalene, below the VGES for these compounds, were also detected in the groundwater sample from MW-2.

The groundwater sample collected from upgradient monitoring well MW-3 contained concentrations of 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and naphthalene exceeding the VGES for these compounds. Concentrations of toluene, ethylbenzene, and xylenes, below the VGES, were also detected in the sample from MW-3.

The groundwater sample collected from downgradient monitoring well MW-4 contained concentrations of benzene, ethylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and naphthalene exceeding the VGES for these compounds. Concentrations of toluene and xylenes, below the VGES, were also detected in the sample from MW-4.

The groundwater sample collected from downgradient monitoring well MW-5 contained concentrations of benzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and naphthalene exceeding the VGES for these compounds. Concentrations of toluene, ethylbenzene, and xylenes, below the VGES, were also detected in the sample from MW-5.

D. Sensitive Receptor Survey

A qualitative risk assessment was conducted on April 15, 1999, to identify known and potential receptors of the contamination detected at the Site. Based on this visual survey, a determination of the potential risk to identified receptors was made.

The soil and groundwater in the vicinity of the USTs and the fuel dispenser island are receptors of the contamination detected.

The depth to groundwater in the monitoring wells measured on April 29, 1999, was approximately 4 to 6 feet below ground surface. Given these groundwater depths the potential exists for the subsurface utility lines servicing the Site to serve as potential conduits of the detected dissolved petroleum contamination. The known utility lines on the west side of the Site, in a downgradient direction from the Site with respect to the shallow groundwater flow, include natural gas, water, and sewer lines. The downgradient extent of petroleum contamination has not been defined and may extend west of the Site boundaries.

The nearest major surface water is Lake Champlain, located approximately 3,500 feet west-northwest of the Site. There is a westerly flowing unnamed brook approximately 700 feet south of the Site. The risk to the unnamed brook and Lake Champlain is considered minimal given the sufficient distance between the Site and these surface waters.

The risk due to vapors at the Site is minimal based on the non-detection of VOCs with the PID in the unsaturated soils in the borings for the monitoring wells and given that the Citgo building is slab on grade construction and the area surrounding the gasoline USTs is paved. There is currently no evidence to suggest that the indoor air of the basements in the houses on the west side of Shelburne road have been impacted by the detected subsurface petroleum contamination at the Site. However, given the estimated westerly shallow groundwater flow direction, the potential risk of impact to the indoor air of the basements from vapors emanating from groundwater seepage into the basements cannot be discounted.

The Site and surrounding area are serviced by municipal water supplies.

IV. CONCLUSIONS

Based on the results of this initial site investigation at R. Kaigles Citgo, Griffin presents the following conclusions:

- 1) There was a release(s) of petroleum to the subsurface in the vicinity of the gasoline USTs at the Site. The source of the detected petroleum contamination is likely due to spills, overfills, and leaks due to usage over time. The duration and volume of product released is unknown. The UST piping system was replaced in December 1998.

- 2) VOC readings of soils collected during the UST piping replacement in December 1998 indicate that adsorbed petroleum compounds existed in the soils in the immediate vicinity of the USTs and the fuel dispenser island. With the UST piping replaced, it is expected that residual adsorbed petroleum compound concentrations will decrease over time with the progressive action of natural mitigative processes including biodegradation, volatilization, and diffusion.
- 3) Three groundwater monitoring wells, MW-3 through MW-5, were installed by Griffin at the Site on April 15, 1999. VOCs were not detected at concentrations exceeding 1 ppm by field screening methods in soil samples collected from the boring for the upgradient monitoring well MW-3. The highest PID readings in the borings for MW-4 (150 ppm) and MW-5 (100 ppm) were from the soils collected near the water table. The PID readings in these two borings decreased with depth below the water table.
- 4) The depth to groundwater measured in the monitoring wells on April 29, 1999, was approximately 4 to 6 feet below grade. The shallow groundwater flow beneath the Site on this date was generally directed toward the west-southwest at a hydraulic gradient of approximately 4.3%.
- 5) Groundwater samples were collected from the five site monitoring wells on April 29, 1999. Concentrations of select petroleum compounds detected in the groundwater samples exceeded their respective VGES. With the UST piping replaced, it is expected that dissolved petroleum compound concentrations will decrease over time with the progressive action of natural mitigative processes, including dilution, dispersion, and biodegradation.
- 6) The Site and the surrounding area are served by municipal water supplies.
- 7) Based on the estimated shallow groundwater flow direction and the contaminant concentrations detected in the downgradient monitoring wells MW-4 and MW-5, it is possible that there has been some off-site migration of dissolved petroleum compounds. Potential downgradient receptors include utility corridors along Shelburne Road and basements of the houses on the west side of Shelburne Road.

V. RECOMMENDATIONS

Based on the results of this site investigation, Griffin recommends the following:

1. Since select compounds were detected in the groundwater at concentrations exceeding their respective VGES, a confirmatory round of groundwater samples should be collected from the five site related monitoring wells in July 1999 (three months after the initial sampling). The groundwater samples should be analyzed for petroleum compounds by EPA Method 8021B. The frequency and need of future sampling will be reassessed following the July 1999 sampling event.
2. Depth to water measurements should be collected from the five monitoring wells during the April 1999 site visit, to verify the groundwater flow direction and gradient across the Site.
3. The indoor breathing air space of the basements in the houses on the west side of Shelburne Road, across from the Site, should be screened for VOCs with a PID during the next site visit.

REFERENCES

1. USGS 7.5 Minute Topographic Map, Burlington, VT, dated 1948 and photorevised 1987.
2. Griffin International, December 21, 1998, *Kaigles Small Citgo Piping Replacement Inspection*, letter report to Ms. Sue Thayer, Vermont Department of Environmental Conservation, Waste Management Division.
3. Doll, Charles G., ed., 1970, *Surficial Geologic Map of Vermont*, Vermont Geological Survey.
4. Doll, Charles G., ed., 1961, *Centennial Geologic Map of Vermont*, Vermont Geological Survey.

< No vicinity map w/adjacent properties/
receptors

APPENDIX A

Site Location Map

Site Map

Groundwater Contour Map

Contaminant Concentration Map



SOURCE: USGS- BURLINGTON, VERMONT QUADRANGLE

JOB #:39941496



R. KAIGLES CITGO
210 SHELBURNE ROAD
BURLINGTON, VERMONT
SITE LOCATION MAP

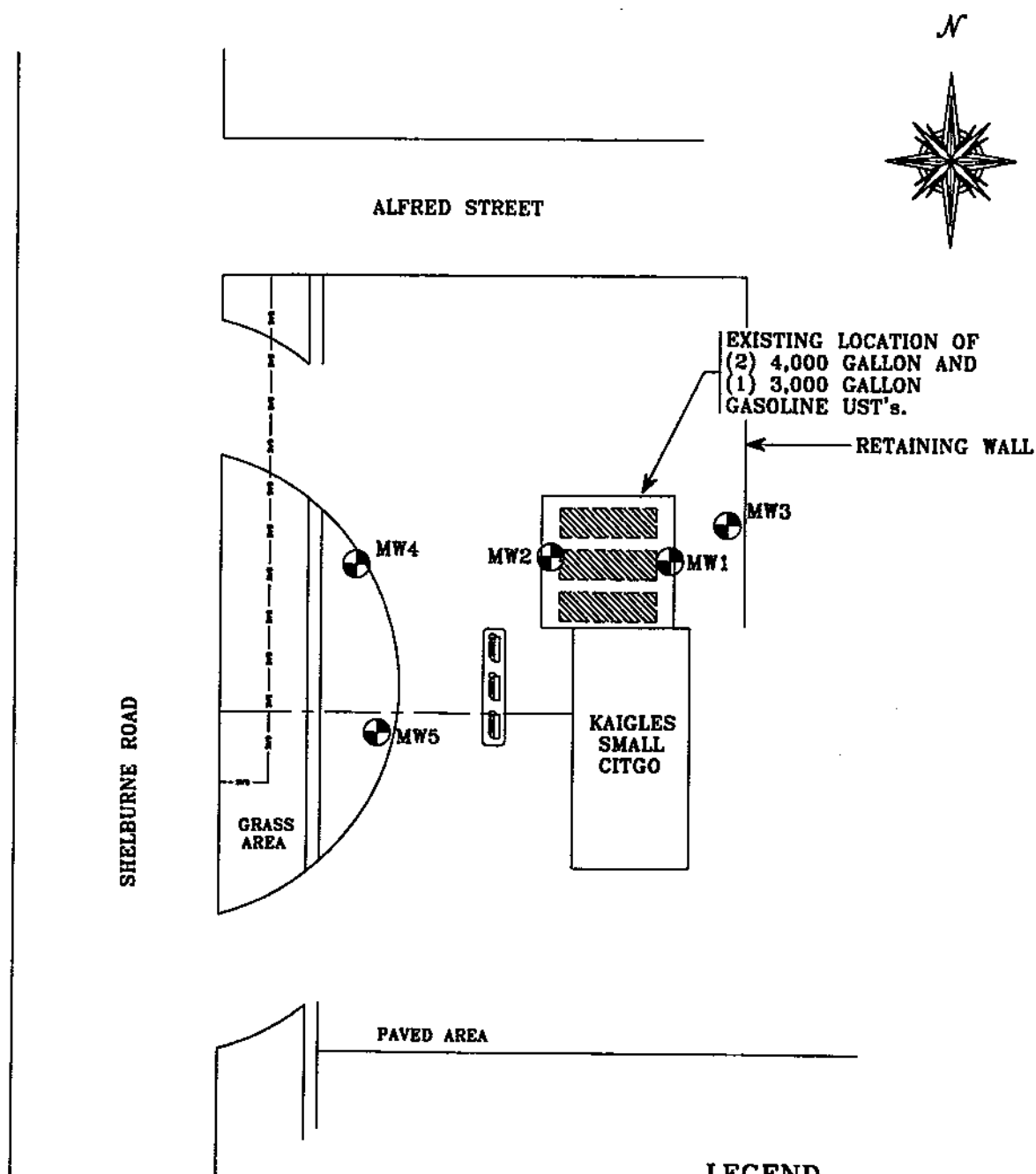
DATE: 4/23/99

DWG.#:1

SCALE: 1:24000

DRN.:SB

APP.:CW



NOTE: SURVEY BY GRIFFIN INTERNATIONAL, INC., UTILITY LOCATIONS BASED ON DIGSAFE MARKINGS.



JOB #: 39941496

R. KAIGLES CITGO
210 SHELburne ROAD
BURLINGTON, VERMONT

SITE MAP

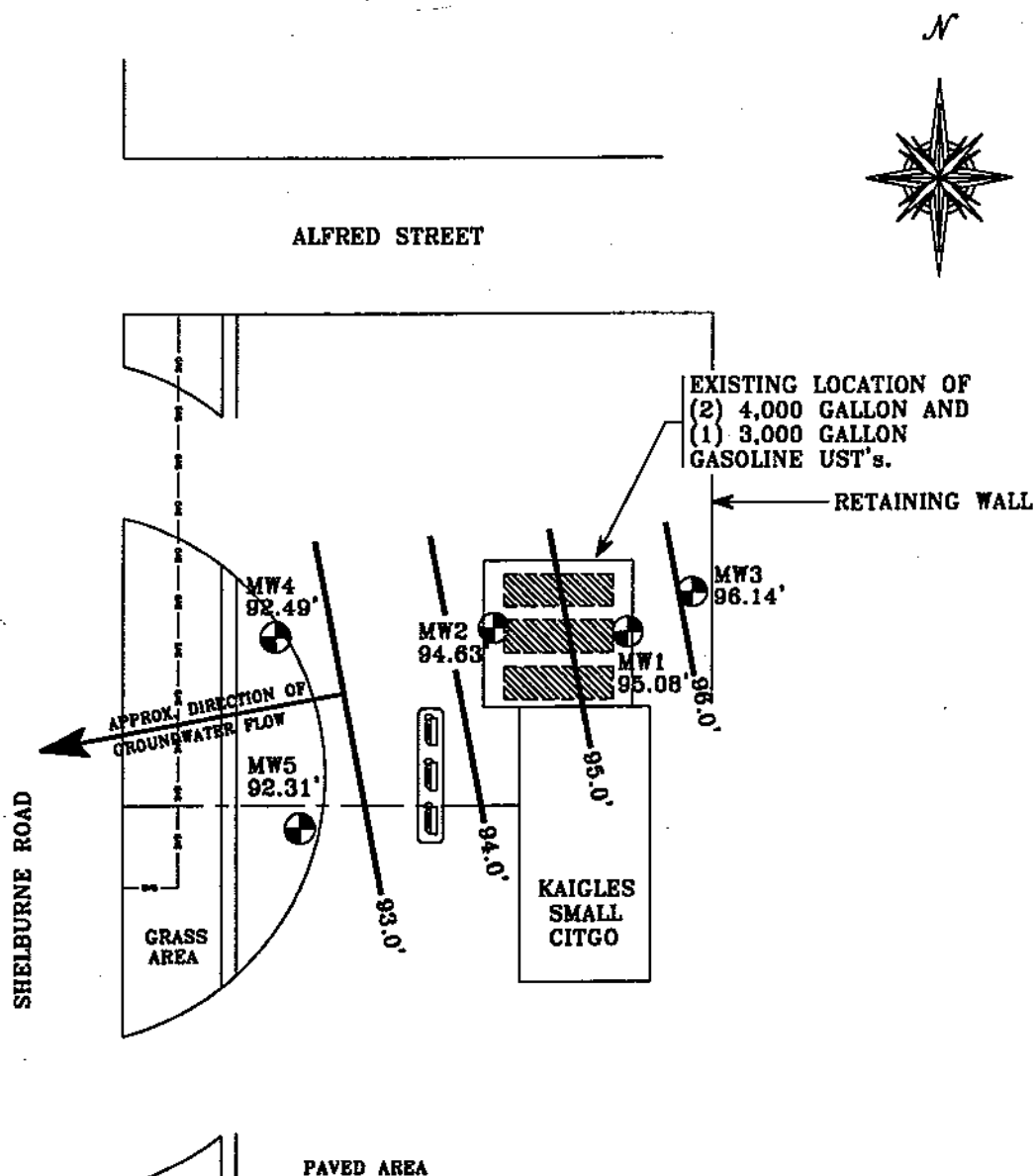
DATE: 6/7/99

DWG. #: 2

SCALE: 1"=40'

DRN.: SB

APP.: CW



LEGEND

MW2 94.63' MONITORING WELL AND WATER TABLE ELEVATION IN FEET

95.0' GROUNDWATER CONTOUR IN FEET (DASHED WHERE INFERRED)

PUMP ISLAND

UNDERGROUND WATER LINE

UNDERGROUND GAS LINE

NOTE: SURVEY BY GRIFFIN INTERNATIONAL, INC., UTILITY LOCATIONS BASED ON DIGSAFE MARKINGS.



JOB #: 39941496

R. KAIGLES CITGO
210 SHELburne ROAD
BURLINGTON, VERMONT

GROUNDWATER CONTOUR MAP
MEASUREMENT DATE: 4/29/99

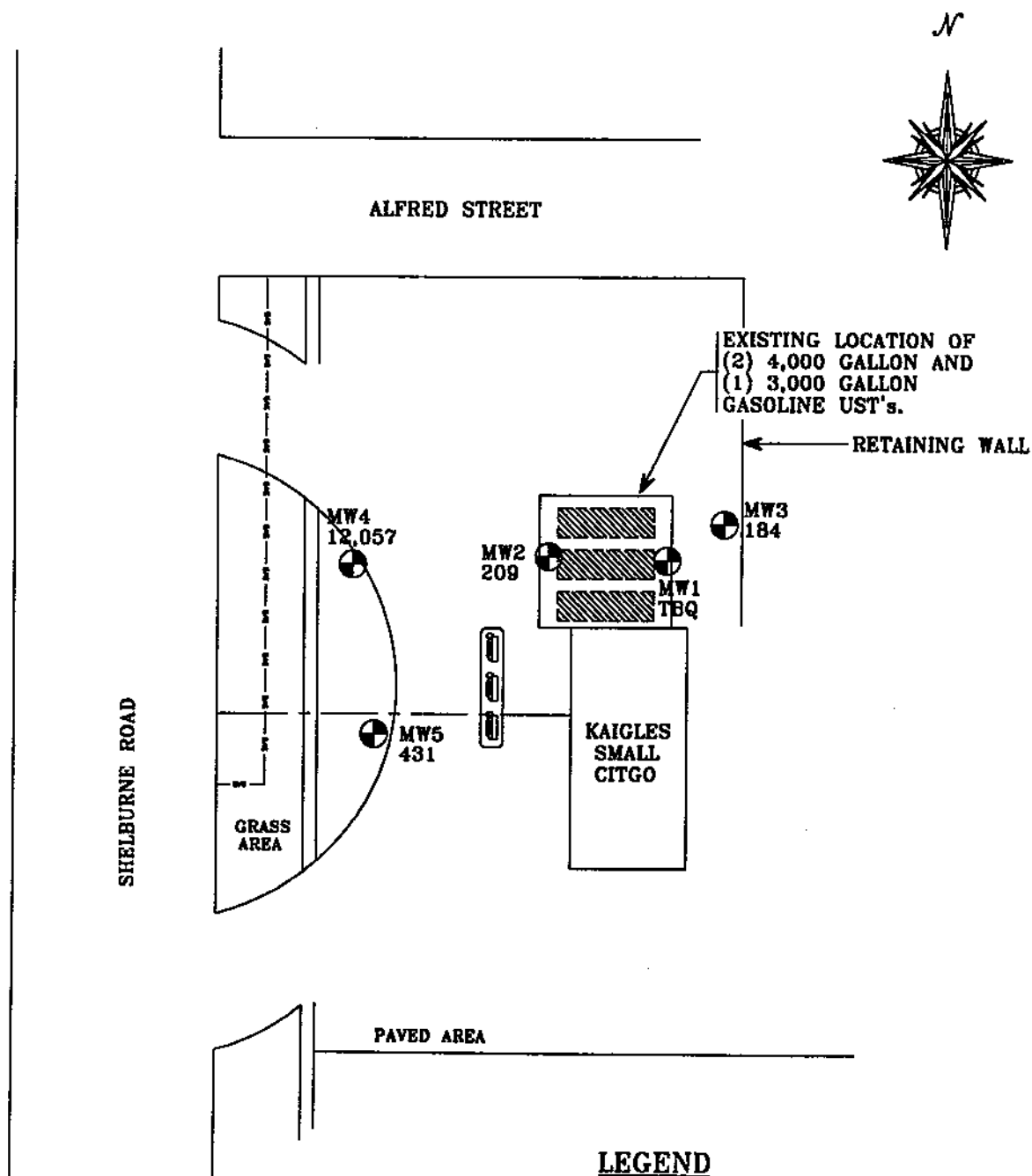
DATE: 6/7/99

DWG.#:3

SCALE: 1"=40'

DRN.:SB

APP.:CW



LEGEND

MW2 209 MONITORING WELL AND TOTAL TARGETED VOCs (ppb)

PUMP ISLAND

UNDERGROUND WATER LINE

UNDERGROUND GAS LINE

NOTE: SURVEY BY GRIFFIN INTERNATIONAL, INC., UTILITY LOCATIONS BASED ON DIGSAFE MARKINGS.



JOB #: 39941496

R. KAIGLES CITGO

210 SHELburne ROAD
BURLINGTON, VERMONT

CONTAMINANT CONCENTRATION MAP
MEASUREMENT DATE: 4/29/99

DATE: 6/7/99

DWG.#:4

SCALE: 1"=40'

DRN.:SB

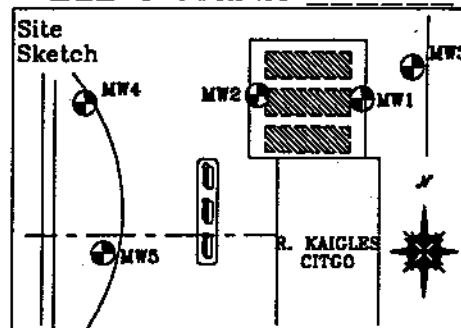
APP.:CW

APPENDIX B

Soil Logs and Monitoring Well Specifications

PROJECT KAIGLES SMALL CITGO
 LOCATION 210 SHELBURNE ROAD, BURLINGTON, VERMONT
 DATE DRILLED 4/15/99 TOTAL DEPTH OF HOLE 14.8'
 DIAMETER 2.75"
 SCREEN DIA. 1.5" LENGTH 10.0' SLOT SIZE 0.010"
 CASING DIA. 1.5" LENGTH 3.75' TYPE sch 40 pvc
 DRILLING CO. ADAMS ENGR. DRILLING METHOD VIBRATORY
 DRILLER GERRY ADAMS LOG BY C. WARD

WELL NUMBER MW3

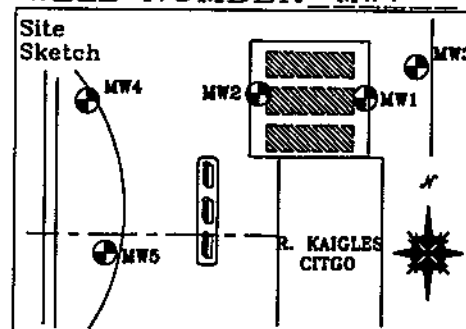


GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0		ROAD BOX			0
1		LOCKING WELL CAP			1
2		CONCRETE	0'-2'	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)- 10% silt, 70% medium to coarse sand, 20% fine gravel, dry, brown.	2
3		BENTONITE	0 ppm	FAT CLAY WITH SAND (CH)- 75% clay, 20% fine sand, 5% fine gravel, moist, brown.	3
4		WELL RISER	2'-4.8'		4
5			0 ppm		5
6				SANDY LEAN CLAY WITH GRAVEL (CL)- 65% clay, 20% fine sand, 15% gravel, wet, brown.	6
7		SAND PACK	4.8'-9.8'		7
8			0.2 ppm		8
9				8.8' WATER TABLE	9
10		WELL SCREEN	9.8'-11.8'	SANDY LEAN CLAY WITH GRAVEL (CL)- 65% clay, 20% fine sand, 15% gravel, wet, brown.	10
11			0.1 ppm		11
12				SANDY LEAN CLAY (CL)- 65% clay, 25% sand, 10% gravel, wet, purple/gray.	12
13		BOTTOM CAP	11.8'-14.8'		13
14			0.1 ppm		14
15		UNDISTURBED NATIVE SOIL		BASE OF WELL AT 14'	15
16				END OF EXPLORATION AT 14.8'	16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
25					25

PROJECT KAIGLES SMALL CITGO
 LOCATION 210 SHELBURNE ROAD, BURLINGTON, VERMONT
 DATE DRILLED 4/15/99 TOTAL DEPTH OF HOLE 12.0'
 DIAMETER 2.75"
 SCREEN DIA. 1.5" LENGTH 10.0' SLOT SIZE 0.010"
 CASING DIA. 1.5" LENGTH 1.75' TYPE sch 40 pvc
 DRILLING CO. ADAMS ENGR. DRILLING METHOD VIBRATORY
 DRILLER GERRY ADAMS LOG BY C. WARD

WELL NUMBER MW4



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0		ROAD BOX			0
1		LOCKING WELL CAP			1
2		CONCRETE			2
3		BENTONITE	0'-4.5'	POORLY GRADED SAND WITH SILT (SP-SM)- 10% silt, 80% fine to coarse sand, 10% fine gravel, dry, yellow/brown.	3
4		WELL RISER	0 ppm		4
5				SILTY SAND (SM)- 20% silt, 70% sand, 10% gravel, moist, yellow/brown.	5
6		SAND PACK	4.5'-6'	6.0' WATER TABLE	6
7			4 ppm		7
8			6'-8.5'	LEAN CLAY (CL)- 90% clay, 10% fine sand, wet, black.	8
9			20 ppm		9
10		WELL SCREEN	8.5'-9.5'	SILT WITH SAND (ML)- 75% silt, 20% fine sand, 5% gravel, wet, gray/brown.	10
11			150 ppm		11
12		BOTTOM CAP	9.5'-12'	GRAVELLY SILT (ML)- 70% silt, 10% fine sand, 20% gravel, wet, gray/brown.	12
13		UNDISTURBED NATIVE SOIL	10 ppm	BASE OF WELL AT 12' REFUSAL AT 12'	13
14					14
15					15
16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
25					25

PROJECT KAIGLES SMALL CITGO

LOCATION 210 SHELBURNE ROAD, BURLINGTON, VERMONT

DATE DRILLED 4/15/99 TOTAL DEPTH OF HOLE 12.1'

DIAMETER 2.75"

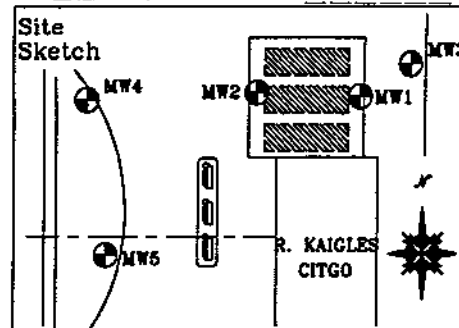
SCREEN DIA. 1.5" LENGTH 10.0' SLOT SIZE 0.010"

CASING DIA. 1.5" LENGTH 1.75' TYPE sch 40 pvc

DRILLING CO. ADAMS ENGR. DRILLING METHOD VIBRATORY

DRILLER GERRY ADAMS LOG BY C. WARD

WELL NUMBER MW5



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0	ROAD BOX				0
1	LOCKING WELL CAP				1
2	CONCRETE			POORLY GRADED SAND WITH SILT (SP-SM)- 10% silt, 90% fine to coarse sand, dry, yellow/brown.	2
3	BENTONITE				3
4	WELL RISER		0'-5' 0.1 ppm		4
5					5
6	SAND PACK		5'-7' 0.2 ppm	POORLY GRADED SAND (SP)- 5% silt, 90% medium to coarse sand, 5% gravel, moist, brown.	6
7			7'-7.5' 100 ppm	7.0' WATER TABLE	7
8	WELL SCREEN		7.5'-10' 50 ppm	SILT (ML)- 90% silt, 10% fine sand, wet, dark gray.	8
9				SANDY SILT (ML)- 65% silt, 25% fine sand, 10% gravel, wet, red/brown.	9
10				SILT WITH SAND (ML)- 80% silt, 15% fine sand, 5% fine gravel, wet, brown.	10
11	BOTTOM CAP		10'-12.1' 1.2 ppm		11
12	UNDISTURBED NATIVE SOIL			BASE OF WELL AT 12' REFUSAL AT 12.1'	12
13					13
14					14
15					15
16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
25					25

APPENDIX C

Liquid Level Monitoring Data

LIQUID LEVEL MONITORING DATA

R. KAIGLES CITGO
210 SHELBURNE ROAD
BURLINGTON, VERMONT

4/29/99

Well I.D.	Well Depth bgs	Top of Casing Elevation	Depth To Product btoc	Depth To Water btoc	Product Thickness	Specific Gravity Of Product	Water Equivalent	Corrected Depth To Water	Corrected Water Table Elevation
MW-1	9	100.00	-	4.92	-	-	-	-	95.08
MW-2	8.5	99.44	-	4.81	-	-	-	-	94.63
MW-3	14	99.96	-	3.82	-	-	-	-	96.14
MW-4	12	97.72	-	5.23	-	-	-	-	92.49
MW-5	12	98.25	-	5.94	-	-	-	-	92.31

All Values Reported in Feet

btoc - Below Top of Casing

bgs - Below Ground Surface

Elevations determined relative to top of casing of MW-1, which was arbitrarily set at 100'

Top of Casing Elevations surveyed by Griffin on 4/15/99

APPENDIX D

Water Quality Data

WATER QUALITY DATA

R. KAIGLES CITGO
SHELBURNE ROAD
BURLINGTON, VERMONT

MONITORING WELL MW-1

PARAMETER	Sample Date: Analytical Method:	4/29/99 8021B				VGES (ppb)
Benzene		ND>1				5.
Toluene		ND>1				1,000.
Ethylbenzene		ND>1				700.
Xylenes		ND>1				10,000.
Total BTEX		ND				-
MTBE		ND>10				40.
1,3,5-Trimethylbenzene		ND>1				4.
1,2,4-Trimethylbenzene		ND>1				5.
Naphthalene		TBQ<1				20.
Total Targeted VOCs		TBQ				-

MONITORING WELL MW-2

PARAMETER	Sample Date: Analytical Method:	4/29/99 8021B				VGES (ppb)
Benzene		ND>5				5.
Toluene		5.0				1,000.
Ethylbenzene		8.2				700.
Xylenes		30.9				10,000.
Total BTEX		44.1				-
MTBE		ND>50				40.
1,3,5-Trimethylbenzene		25.7				4.
1,2,4-Trimethylbenzene		139.				5.
Naphthalene		TBQ<5				20.
Total Targeted VOCs		209.				-

All Values Reported in ug/L (ppb)

ND>1 - None Detected above Detection Limit

TBQ<1 - Trace Below Quantitation Limit

Detections are bolded.

Blank cell - not analyzed

VGES - Vermont Groundwater Enforcement Standard

>VGES

WATER QUALITY DATA

R. KAIGLES CITGO
SHELBURNE ROAD
BURLINGTON, VERMONT

MONITORING WELL MW-3

PARAMETER	Sample Date: Analytical Method:	4/29/99 8021B				VGES (ppb)
Benzene		ND>1				5.
Toluene		6.4				1,000.
Ethylbenzene		3.4				700.
Xylenes		57.6				10,000.
Total BTEX		67.4				-
MTBE		ND>10				40.
1,3,5-Trimethylbenzene		16.5				4.
1,2,4-Trimethylbenzene		36.6				5.
Naphtalene		63.5				20.
Total Targeted VOCs		184.0				-

MONITORING WELL MW-4

PARAMETER	Sample Date: Analytical Method:	4/29/99 8021B				VGES (ppb)
Benzene		60.6				5.
Toluene		54.0				1,000.
Ethylbenzene		1,420.				700.
Xylenes		6,640.				10,000.
Total BTEX		8,175.				-
MTBE		ND>500				40.
1,3,5-Trimethylbenzene		990.				4.
1,2,4-Trimethylbenzene		2,760.				5.
Naphtalene		132.				20.
Total Targeted VOCs		12,057.				-

All Values Reported in ug/L (ppb)

ND>1 - None Detected above Detection Limit

TBQ<1 - Trace Below Quantitation Limit

Detections are bolded.

Blank cell - not analyzed

VGES - Vermont Groundwater Enforcement Standard

>VGES

WATER QUALITY DATA

R. KAIGLES CITGO
SHELBURNE ROAD
BURLINGTON, VERMONT

MONITORING WELL MW-5

Sample Date:	4/29/99				VGES
Analytical Method:	8021B				(ppb)
PARAMETER					
Benzene	8.0				5.
Toluene	6.5				1,000.
Ethylbenzene	14.8				700.
Xylenes	23.4				10,000.
Total BTEX	52.7				-
MTBE	ND>50				40.
1,3,5-Trimethylbenzene	57.4				4.
1,2,4-Trimethylbenzene	246.				5.
Naphthalene	74.9				20.
Total Targeted VOCs	431.				-

All Values Reported in ug/L (ppb)

ND>1 - None Detected above Detection Limit

TBQ<1 - Trace Below Quantitation Limit

Detections are bolded.

Blank cell - not analyzed

VGES - Vermont Groundwater Enforcement Standard

>VGES

APPENDIX E

Analytical Laboratory Report: Groundwater



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

REPORT OF LABORATORY ANALYSIS

CLIENT: Griffin International
PROJECT NAME: Kaigles Small Citgo
REPORT DATE: May 11, 1999
DATE SAMPLED: April 29, 1999

ORDER ID: 2172
REF.#: 137,727 - 137,733

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Chain of custody indicated sample preservation with HCl.

All samples were prepared and analyzed by requirements outlined in the referenced method and within the specified holding times. All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced method. Blank contamination was not observed at levels affecting the analytical results.

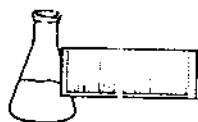
Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

Individual sample performance was monitored by the addition of surrogate analytes to each sample. All surrogate recovery data was determined to be within laboratory QA/QC guidelines unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.
Laboratory Director

enclosures

**ENDYNE, INC.****Laboratory Services**

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

EPA METHOD 8021B--PURGEABLE AROMATICS

CLIENT: Griffin International

DATE RECEIVED: April 30, 1999

PROJECT NAME: Kaigles Small Citgo

REPORT DATE: May 11, 1999

CLIENT PROJ. #: NI

ORDER ID: 2172

Ref. #:	137,727	137,728	137,729	137,730	137,731
Site:	Trip Blank	MW #3	Duplicate	MW #4	MW #5
Date Sampled:	4/29/99	4/29/99	4/29/99	4/29/99	4/29/99
Time Sampled:	8:11	10:07	10:07	10:16	10:31
Sampler:	RH	RH	RH	RH	RH
Date Analyzed:	5/8/99	5/8/99	5/8/99	5/10/99	5/10/99
UIP Count:	0	> 10	> 10	> 10	> 10
Dil. Factor (%):	100	100	100	2	20
Surr % Rec. (%):	97	97	96	93	94
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
MTBE	<10	<10	<10	<500	<50
Benzene	<1	<1	<1	60.6	8.0
Toluene	<1	6.4	6.0	54.0	6.5
Ethylbenzene	<1	3.4	3.1	1,420.	14.8
Xylenes	<1	57.6	53.0	6,640.	23.4
1,3,5 Trimethyl Benzene	<1	16.5	15.0	990.	57.4
1,2,4 Trimethyl Benzene	<1	36.6	33.2	2,760.	246.
Naphthalene	<1	63.5	59.6	132.	74.9

Ref. #:	137,732	137,733			
Site:	MW #2	MW #1			
Date Sampled:	4/29/99	4/29/99			
Time Sampled:	10:39	10:50			
Sampler:	RH	RH			
Date Analyzed:	5/10/99	5/10/99			
UIP Count:	> 10	5			
Dil. Factor (%):	20	100			
Surr % Rec. (%):	103	95			
Parameter	Conc. (ug/L)	Conc. (ug/L)			
MTBE	<50	<10			
Benzene	<5	<1			
Toluene	5.0	<1			
Ethylbenzene	8.2	<1			
Xylenes	30.9	<1			
1,3,5 Trimethyl Benzene	25.7	<1			
1,2,4 Trimethyl Benzene	139.	<1			
Naphthalene	TBQ <5	TBQ <1			

Note: UIP = Unidentified Peaks TBQ = Trace Below Quantitation NI = Not Indicated

[illegible]